Use of Electrochemical Advanced Oxidation Processes for Novel Treatment of Sludge and Wastewater

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Farms in Singapore are encouraged to harness technology to optimise food production. Currently, local farms produce 26% of eggs consumed in the nation. While we address food security needs, large amounts of sludge are generated from treated chicken fecal matter. Due to high concentrations of organic matter and bacteria, this sludge must be treated before discharge to minimise environmental harm. However, conventional treatment methods are unsuitable as they are energy and time intensive for local farmers. Our study presents a novel hybrid of two Electrochemical Advanced Oxidation Processes [Electroperoxi-coagulation (EPC) and Electro-Fenton reaction (EF)] for effective and low-cost treatment of sludge from a local chicken farm. Initially, the EPC-EF process was successfully tested for the removal of organics, with the Biological Oxygen Demand decreasing by 89.1% after 6h of treatment, rendering it safe to be discharged. Subsequent treatment was also found to be efficient in disinfecting the sludge, with quantitative microbiological analysis showing a remarkable 100% removal of coliforms. Meanwhile, thiosulfate, both a common chicken fertiliser additive and a pollutant discharged by global chemical industries is known to cause environmental harm. Therefore, remediation of thiosulfate was also investigated by means of EF. Thiosulfate was completely removed following 1h of EF treatment at a current of 0.3A, significantly outperforming conventional anodic oxidation, which only reached 53% removal in 1h. Our findings provide a leap forward in wastewater treatment technology and will prove critical for application in global industries which produce great amounts of wastewater. Finding better ways of managing our environmental impact forges a more sustainable future for all.

Awards Won:
First Award of $5,000